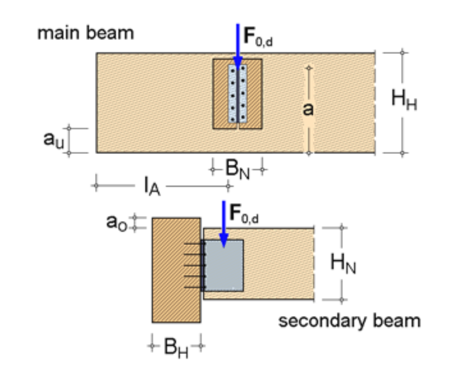
POSITION 20: CONCEALED BEAM HANGER ALU

4H-HOLZ concealed beam hanger connection

(4H-HLZ72 Version: 1/2012-1a) (principle sketch)



calculation bases:
DIN EN 1995-1-1:2010-12 (EC5) /NA:2010-12,
BAZ Z-9.1-290 und ETA-04/0013

sizes of main and secondary beam (single-sided)
H_H = 320 mm B_H = 240 mm a_O = 50 mm
H_N = 220 mm B_N = 120 mm a_U = 50 mm
l_A = 46 mm a = 166 mm

service class 2

species/timber grade
main beam: coniferous timber, timber grade C24
secondary beam: coniferous timber, timber grade C24

internal forces and factors
$F_{0,d}$ force parallel to web

combinations of internal forces BT (design values)

LK-Nr.	KLED	$F_{0,d}$	$F_{90,d}$	$N_{,d}$	k_{mod}
1	permanent	1.50 kN	---	---	0.60

connection method standard concealed beam hanger
make BT concealed beam hanger ALU 120 - 4
conc. beam h. size width b = 62.0 mm height h = 116.0 mm length l = 103.0 mm st.pl.th. t = 6.0 mm
dowel d_{St} = 12.0 mm l_{St} = 120.0 mm M_{yk} = 69.1 Nm
nails CNA ribbed nails 4,0x35
d_n = 4.0 mm l_n = 35.0 mm d_k = 8.0 mm l_g = 25.0 mm M_{yk} = 6.6 Nm

verifications

combination of internal forces 1 (design values)

LK-Nr.	KLED	$F_{0,d}$	$F_{90,d}$	$N_{,d}$	k_{mod}
1	permanent	1.50 kN	---	---	0.60

nail anchorage capacities (withdrawal)
main beam $f_{1,k}$ = 6.125 N/mm² $R_{ax,k}$ = 0.613 kN $R_{ax,d}$ = 0.283 kN

nail anchorage capacities (shear)
main beam $f_{h,k}$ = 18.935 N/mm² $R_{1a,k}$ = 1.628 kN $R_{1a,d}$ = 0.751 kN

dowel anchorage capacities (shear), simplified method NA:2010-12
secondary beam $f_{h,k}$ = 16.507 N/mm² $R_{,k}$ = 4.651 kN $R_{,d}$ = 2.537 kN t_{req} = 85.9 mm

load-carrying capacity concealed beam hanger (full nailing)
material safety factors $\gamma_{M,timber}$ = 1.30 $\gamma_{M,steel}$ = 1.10

load-carrying capacity main beam connection $R_{1,k} = R_{1a,k} + \Delta R_{,k}$ = 1.628 kN $R_{1,d}$ = 0.751 kN (1)
number of nails n_{Na} = 20 $\gamma_{M,calc}$ = 1.30
$F_{1,d}$ = 1.50 kN $R_{1,d}$ = 15.03 kN $F_{1,d}/R_{1,d}$ = 0.10 ≤ 1.00 verification successful

load-carrying capacity secondary beam connection (2)
number of dowels n_{St} = 3 $\gamma_{M,calc}$ = 1.10
$F_{1,d}$ = 1.50 kN $R_{1,d}$ = 15.22 kN $F_{1,d}/R_{,d}$ = 0.10 ≤ 1.00 verification successful

decisive is main beam-load-carrying capacity $R_{1,d}$ = 15.03 kN

verification of splitting capacity (3)
For a/H_H = 0.519 ≤ 0.7 verif. of splitting capacity is required.
Es the following requirement should be satisfied: $F_{90,d} / R_{90,d} \leq 1.0$
$F_{90,d}$ design value of the force component perpendicular to grain
$R_{90,d}$ design splitting capacity of the beams

$$R_{90,d} = k_s * k_r * (6.5 + 18.*a^2/H_H^2) * (t_{ef} * H_H)^{0.8} * f_{t,90,d}$$

a = 166.0 mm H_H = 320.0 mm a/H_H = 0.519 a_r = 46.0 mm t_{ef} = 48.0 mm
h_1 = 154.0 mm k_s = 1.000 k_r = 1.000 l_{Ag} = 46.0 mm k_g = 1.000
$f_{t,90,k}$ = 0.400 N/mm² $f_{t,90,d}$ = 0.185 N/mm² $F_{90,d}$ = 1.50 kN $R_{90,d}$ = 2.00 kN
$F_{90,d} / R_{90,d}$ = 1.50 / 2.00 = 0.75 ≤ 1.0 verification successful

LK1: all verifications successful.

summary

maximum utilization max U = 0.75, decisive load combination 1, verification 3